

**SNS RFQ Alpha Module  
Cooling and Instrumentation Scheme**

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## **Introduction**

The SNS RFQ Alpha Module contains a series of water cooling channels in both the cavity walls and the vane tips. The Pi-mode stabilizing rods consist of copper tubes which are also cooled by water. Layouts of the cooling scheme including manifolds, valves, cooling port names and temperature, flow and pressure instrumentation are shown in Figures 1 through 3. The [TEMP] boxes indicate a water temperature measurement by means of a fitting containing a thermal probe and controller. The [FLOW] boxes represent an in-line measurement of water flow using an impeller type flow meter and controller. The [PRES] boxes represent a water pressure measurement with a transducer and controller. All signals will be fed into the control system. The RFQ vanes are represented by the rectangles with dotted lines. Water manifolds are shown as long rectangular boxes with solid lines. The port names shown in the schematics are tentative at this time. Pipe thread designations are also shown where applicable. The small chiller is an 18 kW, 30 gpm closed loop unit to be used for the RFQ vane channels only. The large chiller is a 25 kW, 100 gpm closed loop unit to be used for the wall channels, Pi-mode rods and MEBT rebuncher cavities.

### **RFQ Vane Tip Channels**

The schematic for the RFQ vane tip cooling channels is shown in Figure 1. The inlet pressure and temperature will be measured at the supply manifold, and the outlet temperature and flow rate will be measured for each vane as well as the pressure at the return manifold. A manual flow control valve will be used to control the overall flow through the 4 vane channels.

### **RFQ Wall Channels**

The schematic for the RFQ wall cooling channels is shown in Figure 2. The inlet pressure and temperature will again be measured at the supply manifold, and the outlet temperatures and flows will be measured after combining the flow for each of the 4 individual vanes. The pressure at the return manifold will also be measured. A manual flow control valve will be used to control the overall flow through the wall channels.

### **RFQ Pi-mode Rods**

The schematic for the RFQ Pi-mode rods is shown in Figure 3. Each pair of adjacent rods will be jumpered at the opposite end of the supply fitting so that the return is next to the supply. The inlet pressure is measured, and the combined water temperature for 6 sets of rods will be measured at the 2 points shown. The total flow through the rods and the pressure at the return manifold will also be measured. A manual flow control valve will again be used to control the overall flow through the Pi-mode rods.

## Embedded Temperature Sensors

A set of 4 thermocouple probes will also be used to measure the temperature of the actual vane material. The probes will be located in holes drilled through the Glidcop and into the OFE copper vane to a depth of about 2.5" (~2" out from the RFQ centerline). The holes will be located approximately 31" downstream from the start of the Alpha Module.

## Summary

A summary of the number of temperature, pressure and flow measurements to be made on the SNS RFQ Alpha Module is given in the table below:

<u>Component Name</u>	<u># Temp.</u>	<u># Flow</u>	<u># Pres.</u>
Vane cooling water	5	4	2
Wall cooling water	5	4	2
Pi-mode rods	2	1	2
Vane copper	4	n/a	n/a
Totals	16	9	6

These quantities have been selected for use on the Alpha Module only. The configuration of the devices for the full RFQ is yet to be determined. It is likely that the full RFQ will use somewhat fewer devices per module than presented here.

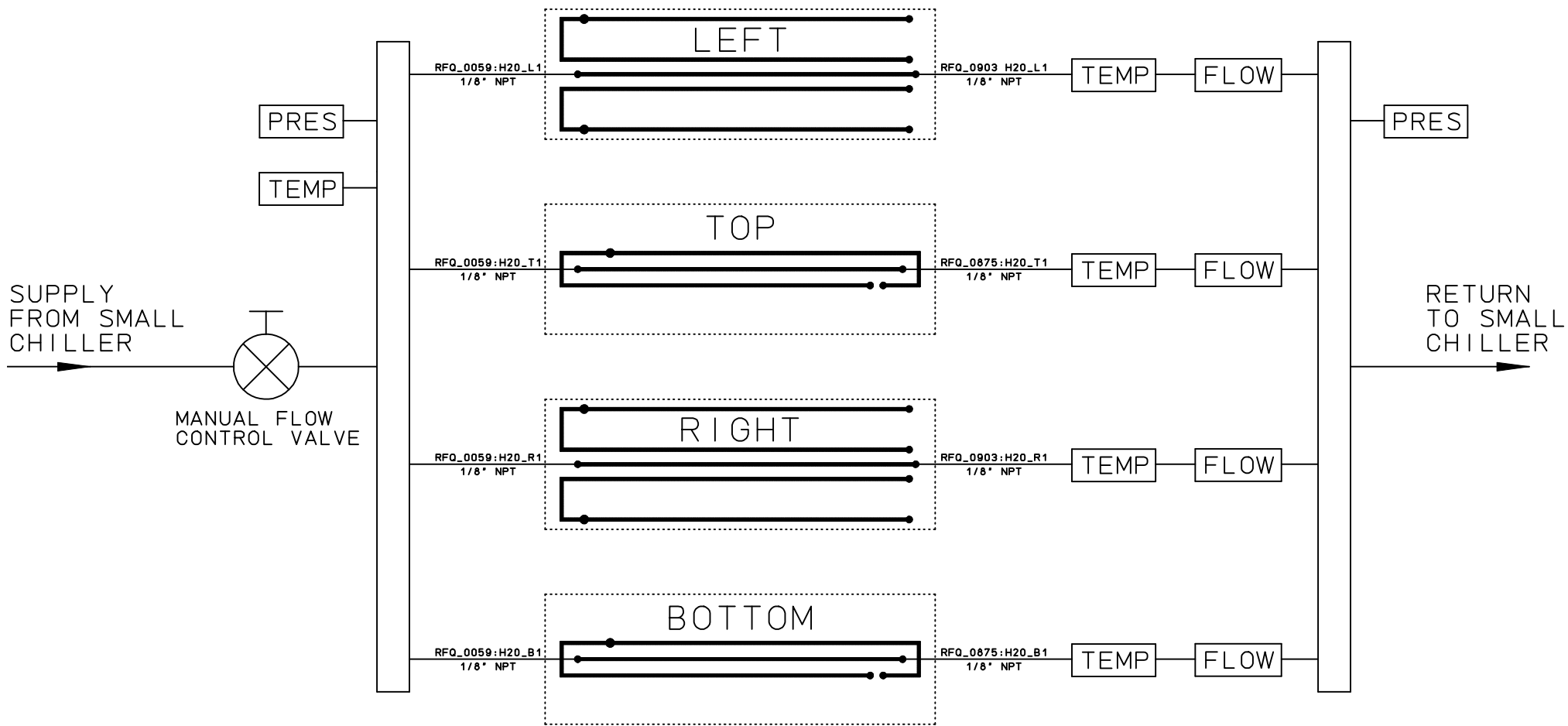


Figure 1. Cooling and instrumentation schematic for the Alpha Module vane tips.

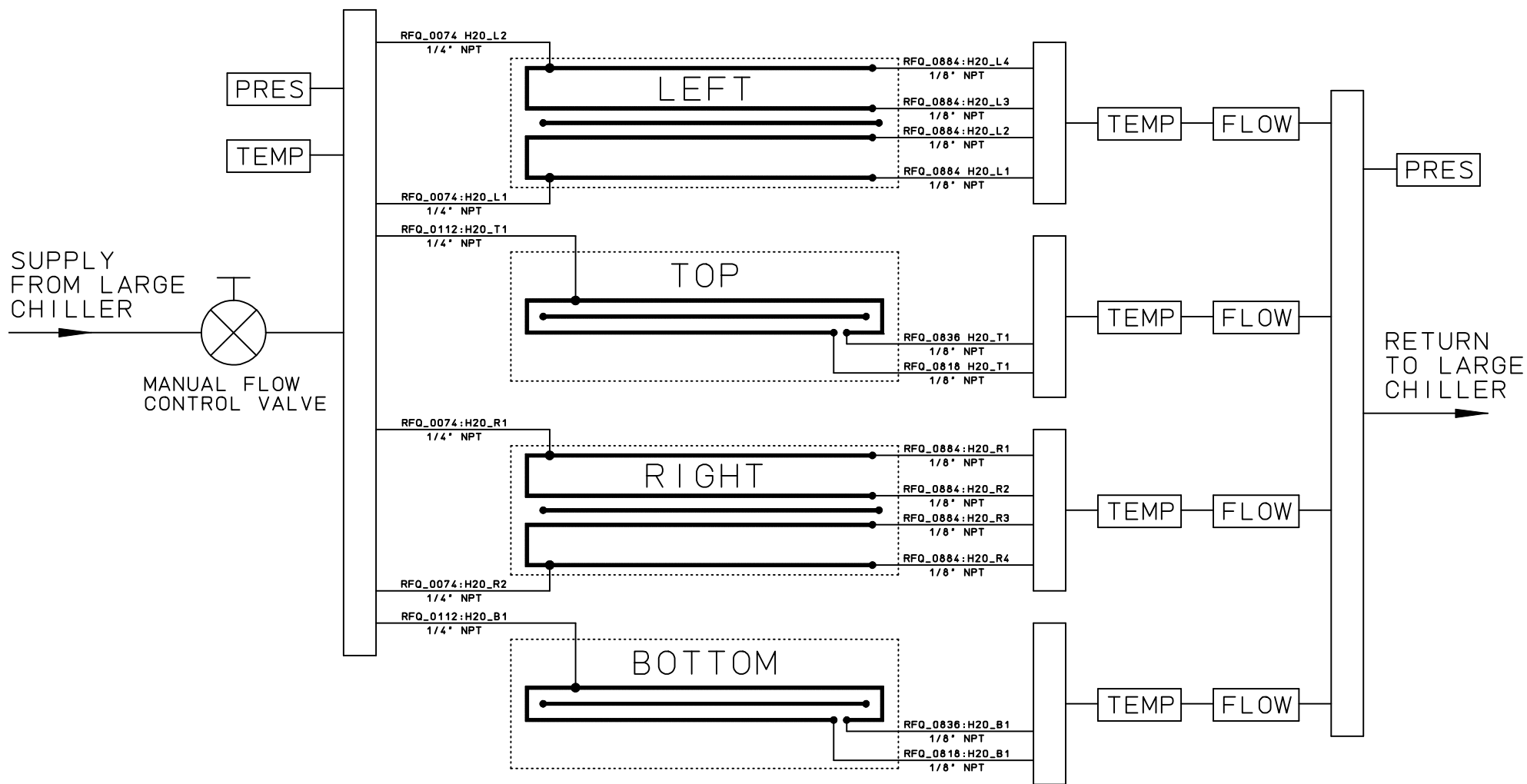


Figure 2. Cooling and instrumentation schematic for the Alpha Module wall channels.

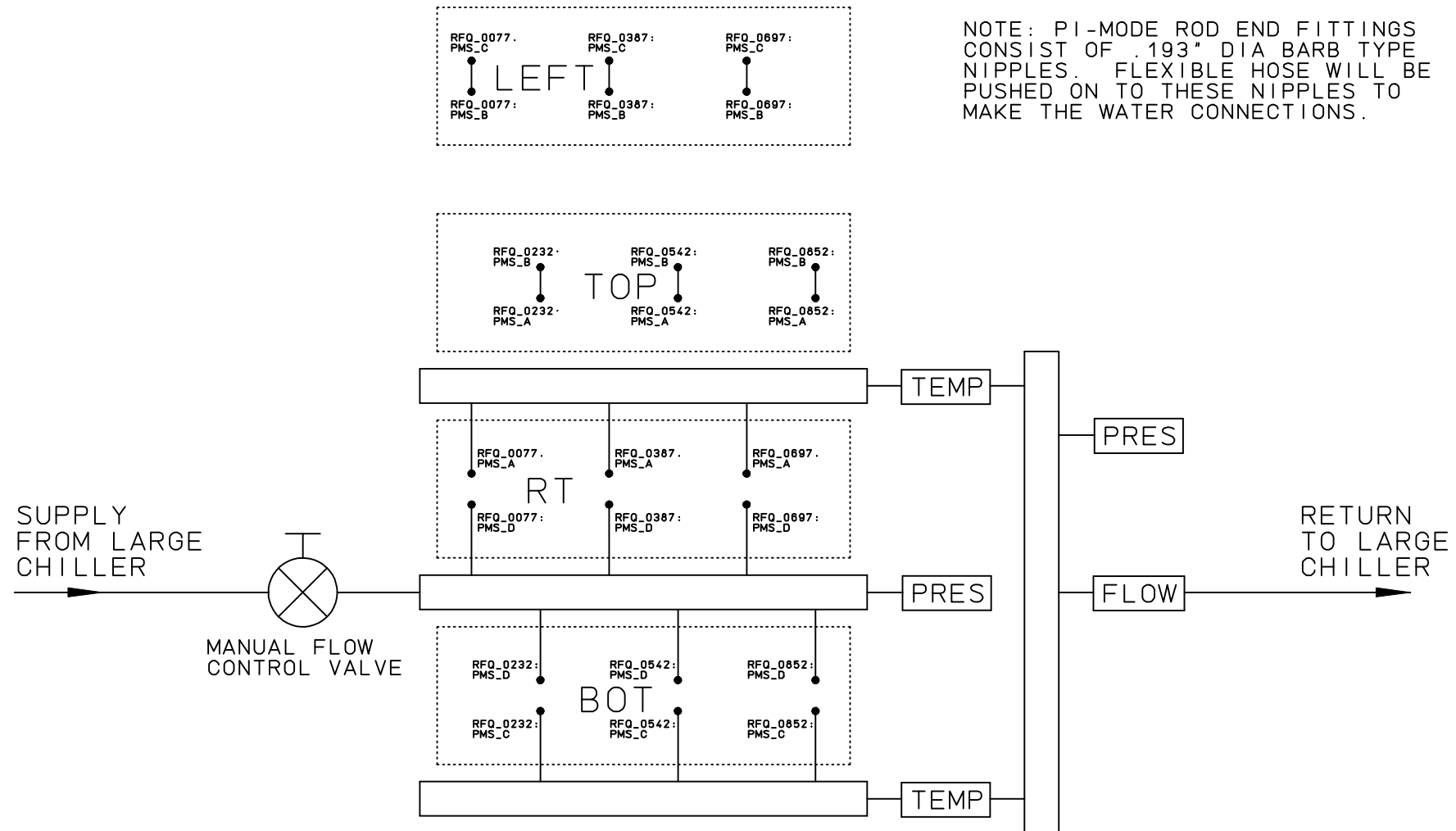


Figure 3. Cooling and instrumentation schematic for the Alpha Module Pi-mode rods.